Amendments to the Claims: This listing of claims will replace all prior versions and listings of clams in the application.

Listing of Claims

What is claimed is:

1. (Canceled)

2. (New) A fuel cell electrode assembly comprising:
A first single monolithic substrate; anode and cathode metallic conductor structures; anode and cathode electrode catalyst structures; ion exchange membrane structures; fuel and oxidizer channel structures; channel cover plate structures; fuel and oxidizer manifold supply and exhaust structures; all said structures fabricated sequentially on a single side of said single monolithic substrate and.

said fuel cell electrode assembly arranged such that proton exchange takes place within said ion exchange membrane structures in a plane parallel to said single monolithic substrate and

said fuel cell electrode assembly contains a plurality of anode and cathode electrode catalyst structures and ion exchange membranes wherein the thickness of said electrode structures and ion exchange structures is greater than the width of the ion exchange membrane structures.

3. (Canceled) The fuel cell of claim 1 wherein the ion exchange process takes place predominantly in a direction parallel to the surface of a single monolithic substrate.

4. (Canceled) The fuel cell of claim 1 wherein the dimensions of the ion exchange membrane orthogonal to the plane of the substrate and perpendicular to ion flow may be much larger than the dimensions in the plane of the substrate

in order to facilitate a larger surface area for ion exchange and to yield higher output power density per unit area of substrate.

5. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein the dimension of the ion exchange membrane structures orthogonal to the plane of ~~the substrate~~ said single monolithic substrate and perpendicular to ion flow ~~may be~~ is much larger than the dimension in the plane of the substrate. ~~in order to facilitate a larger a larger surface area for ion exchange and to yield higher output power density per unit area of substrate.~~

6. (Canceled) The fuel cell of claim 1 wherein such cell consists of a single fuel cell or a multiplicity of single fuel cells disposed over a single monolithic substrate.

7. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~such cell~~ said fuel cell electrode assembly consists of a single fuel cell electrode assembly or a multiplicity of single ~~fuel cells~~ fuel cell electrode assemblies disposed over ~~a~~ said single monolithic substrate.

8. (Canceled) The fuel cell of claim 1 wherein all components described are disposed on one side of a monolithic substrate.

9. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein all ~~components described~~ said structures are disposed on one side of ~~a~~ said single monolithic substrate.

10. (Original) The fuel cell of claim 1 wherein the substrate is comprised of insulating, semi-insulating, semiconducting, or conductive material.

11. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the~~ said single monolithic substrate is comprised of insulating, semi-insulating, semiconducting, or conductive material.

12. (Canceled) The fuel cell of claim 1 wherein singulated fuel cell elements or arrays of unsingulated fuel cell elements are stacked and interconnected to form a higher output power module than would be available from a single fuel cell element or an array of fuel cell elements on a single substrate.

13. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~singulated~~ said single fuel cell electrode assemblies ~~elements~~ or arrays of unsingulated fuel cell electrode assemblies ~~elements~~ are stacked and interconnected to form a higher output power module than would be available from a single fuel cell electrode assembly ~~element~~ or an array of fuel cell electrode assemblies ~~elements~~ on ~~a~~ said single monolithic substrate.

14. (Canceled) The fuel cell of claim 1 wherein individual fuel cells within a single substrate are electrically interconnected to yield a cell array connected variously in series or parallel to provide a variable voltage or current range.

15. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein individual said fuel ~~cells~~ cell electrode assemblies within ~~a~~ said single monolithic substrate are electrically interconnected to yield ~~a cell array~~ an array of said fuel cell electrode assemblies connected variously in series or parallel to provide a variable voltage or current range.

16. (Canceled) The fuel cell of claim 1 wherein manifold supply chambers provide for stacking of individual fuel cells or arrays of fuel cells whereby such manifold chambers are in registration thus allowing the passage of fuel and oxidizer through multiply stacked fuel cells or arrays of fuel cells.

17. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein said fuel and oxidizer manifold supply and exhaust ~~chambers~~ structures within each said fuel cell electrode assembly provide for stacking of individual fuel ~~cells~~ cell electrode assemblies or arrays of fuel ~~cells~~ cell electrode assemblies whereby ~~such~~ said fuel and oxidizer manifold supply and exhaust ~~chambers~~ structures are in registration thus allowing the passage of fuel and oxidizer through multiply stacked fuel ~~cells~~ cell electrode assemblies or arrays of fuel ~~cells~~ cell electrode assemblies.

18. (Canceled) The fuel cell of claim 1 wherein a multiplicity of fuel cells fabricated on a single substrate can be singulated then stacked by hermetically bonding one to another.

19. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein a multiplicity of fuel ~~cells~~ cell electrode assemblies fabricated on ~~a~~ said single monolithic substrate can be singulated then stacked by hermetically bonding one to another.

20. (Canceled) The fuel cell of claim 1 wherein a multiplicity of single fuel cells on a single substrate are interconnected such that electrical current extractor lines are routed to the edge of a single substrate to provide connection to external devices or electrical loads.

21. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein a multiplicity of said single fuel ~~cells~~ cell electrode assemblies on a said single monolithic substrate are electrically interconnected such that said electrical current extractor ~~lines~~ anode and cathode metallic conductor structures are routed to the edge of ~~a~~ said single monolithic substrate to provide connection to external devices or electrical loads.

22. (Canceled) The fuel cell of claim 1 wherein a monolithic semiconductor substrate contains pre-existing active semiconductor circuits for the purpose of controlling operation of the fuel cell.

23. (Canceled) The fuel cell of claim 1 wherein the monolithic substrate contains active MEMS type devices for controlling mechanical functions of the fuel cell.

24. Canceled) The fuel cell of claim 1 wherein all the functional elemental parts of said fuel cell or cells are fabricated by sequential processing on one side of a single monolithic substrate.

25. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein all said fuel cell electrode assembly structures ~~the functional elemental parts~~ of said fuel cell electrode assembly ~~or cells~~ are fabricated by sequential processing on one side of a said single monolithic substrate.

26. (Canceled) The fuel cell of claim 1 wherein the fuel cell structure may be a Proton Exchange Membrane (PEMFC) type or a Solid Oxide Type (SOFC) or Solid Polymer Type (SPFC), depending on the selection of fabrication materials.

27. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the~~ said fuel cell electrode assembly structures may be of a Proton Exchange Membrane (PEMFC) type or a Solid Oxide Type (SOFC) or Solid Polymer Type (SPFC), depending on the selection of fabrication materials.

28. (Canceled) The fuel cell of claim 1 wherein the fuel source is comprised of alcohols, hydrogen gas, or other fuels containing redox pairs.

29. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein the fuel source is comprised of alcohols, hydrogen gas, or other fuels containing redox pairs.

30. (Canceled) The fuel cell of claim 1 wherein the oxidizer source is air or oxygen.

31. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein the oxidizer source is air or oxygen.

32. (Canceled) The fuel cell of claim 1 wherein the operating temperature range may be from 80°C to 800°C depending on the type of said cell and the material system used.

33. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein the operating temperature range ~~may~~ is ~~be~~ from 80°C to 800°C depending on the type of said fuel cell electrode assembly and the material system used.

34. (Canceled) The fuel cell of claim 1 wherein the anode and cathode electrodes are alternated in a single plane on a monolithic single substrate.

35. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the anode and cathode electrodes~~ said anode and cathode metallic conductor structures and anode and cathode electrode catalyst structures are alternated in a single plane on a said single monolithic substrate. ~~monolithic single substrate.~~

36. (Canceled) The fuel cell of claim 1 wherein the fuel and oxidizer channels and electrical conductors are configured in a comb pattern.

37. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the~~ said fuel and oxidizer channels structures ~~and electrical conductors~~ are configured in a comb pattern.

38. (Canceled) The fuel cell of claim 1 wherein the lateral dimensions of the electrical conductors, the membrane material, the electrodes and the fuel and oxidizer channel separators are within the range of from 5 μm to 1 mm. for the purpose of using standard semiconductor and microfabrication manufacturing techniques.

39. Currently Amended) The fuel cell electrode assembly of claim 1 wherein the lateral dimensions of ~~the electrical conductors, the membrane material,the electrodes and the fuel and oxidizer channel separators~~ said electrical anode and cathode metallic conductor ~~line~~ structures, said ion exchange membrane structures, said anode and cathode electrode catalyst structures are within the range of from 5 μm to 1 mm. for the purpose of using standard semiconductor and microfabrication manufacturing techniques.

40. (Canceled) The fuel cell of claim 1 wherein the electrical current extractor lines and the substrate are of high thermal conductivity for the purpose of removing heat from the active region of the fuel cell.

41. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the~~ said electrical current extractor ~~lines~~ anode and cathode metallic conductor structures and ~~the~~ said single monolithic substrate are of high thermal conductivity for the purpose of removing heat from the active region of the fuel cell.

42. (Canceled) The fuel cell of claim 1 wherein structure buildup is accomplished by methods common in the semiconductor and MEMS fabrication industry including but not limited to physical vapor deposition, chemical vapor deposition, plating, spin coating, dipping, spraying and cladding.

43. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein said structures buildup is accomplished by process methods ~~common~~ used in the

semiconductor and MEMS fabrication industry including but not limited to physical vapor deposition, chemical vapor deposition, plating, spin coating, dipping, spraying and cladding.

44. (Canceled) The fuel cell of claim 1 whereby structure patterning is accomplished by standard semiconductor or MEMS photomasking technique followed by etch removal or additive deposition techniques.

45. (Currently Amended) The fuel cell electrode assembly of claim 1 whereby structure patterning is accomplished by ~~standard~~ semiconductor or MEMS photomasking technique followed by etch removal or additive deposition techniques.

46. (Canceled) The fuel cell of claim 1 wherein masking is accomplished using standard photoresist and lithography printing techniques common in the semiconductor and MEMS fabrication industry.

47. (Canceled) The fuel cell of claim 1 wherein subtractive removal is accomplished using either laser ablation, stamping, ultrasonic grinding, lapping or polishing, machining, or wet or dry etching.

48. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~subtractive~~ removal of said structures and temporary support material is accomplished using either laser ablation, stamping, ultrasonic grinding, lapping or polishing, machining, or wet or dry etching.

49. Canceled) The fuel cell of claim 1 wherein subtractive feature formation is accomplished by vacuum etching processes such as sputter etching, reactive ion etching, reactive ion beam etching, deep reactive ion etching.

50. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~subtractive feature~~ said structure formation is accomplished by vacuum etching processes such as sputter etching, reactive ion etching, reactive ion beam etching, deep reactive ion etching.

51. (Canceled) The fuel cell of claim 1 wherein anode and cathode electrical conductor lines are comprised of plated copper, gold, nickel or palladium or a combination of those.

52. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~anode and cathode~~ said electrical anode and cathode metallic conductor structures ~~conductor lines~~ are comprised of plated copper, gold, nickel or palladium or a combination of those.

53. (Canceled) The fuel cell of claim 1 wherein an inert corrosion barrier is comprised of a patterned refractory conductor such as tantalum nitride, titanium-tungsten nitride, or rhodium.

54. (Canceled) The fuel cell of claim 1 wherein a membrane material is deposited by spin coating, dipping, or chemical vapor deposition.

55. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~an~~ said ion exchange membrane structure ~~material~~ is deposited by spin coating, dipping, or chemical vapor deposition.

56. (Canceled) The fuel cell of claim 1 wherein the electrode material is applied to anisotropically etched holes in a membrane by spin coating, dipping or doctor blading, followed by heat curing.

57. (Currently Amended) The fuel cell electrode assembly of claim 1 wherein ~~the~~ said anode and cathode electrode catalyst structure material is applied to

anisotropically etched holes in ~~a~~ said ion exchange membrane structure by spin coating, dipping or doctor blading, followed by heat curing.

58. (Canceled) The fuel cell of claim 1 wherein an insulating barrier layer is applied to the surface of conductive elements by vacuum deposition, chemical vapor deposition or other conventional means for the purpose of electrically insulating one element from another or eliminating corrosion between dissimilar materials.

59. (Canceled) The fuel cell of claim 1 wherein metallic layers are built by plating copper, nickel, gold, or a combination thereof, for example.